MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2016/2017

HBC1021 – BIOCHEMISTRY II

6th March 2017
9:00 -11:00 AM
(2 hours)

INSTRUCTIONS TO STUDENTS

1. This paper consists of **8** pages (including the front page) with **2** Parts (**A** and **B**).

2. **Part A** consists of **20** Multiple Choice Questions (MCQ). All questions carry equal marks (0.5 mark per question). Answer **ALL** questions in the **OMR** provided on page **6** of this paper.

3. **Part B** consists of **4** Short Answer Type questions. All questions carry equal marks (10 marks per question). Answer **ALL** questions. Print your answers **clearly** and **neatly** in the Answer Booklet provided.

SECTION A: MULTIPLE CHOICE QUESTIONS (MCQ)

Questions 1 to 20 [10 marks]

1. Which one of the following statements is **TRUE**?
   A. Many activated carriers are derived from vitamin B.
   B. Coenzyme A is the carrier of three-carbon fragments.
   C. ATP carries an activated acyl group.
   D. ATP can be formed from ADP by coupling to an endergonic reaction.

2. Insulin signaling pathway inhibits _____ while glucagon signaling pathway inhibits _____.
   A. glycolysis, gluconeogenesis
   B. gluconeogenesis, glycolysis
   C. glycogenesis, glycolysis
   D. glycogenesis, glycogenolysis

3. Which one of the following statements about photosynthesis is **TRUE**?
   A. The Calvin cycle occurs exclusively in the absence of the light.
   B. The absorption of light by chlorophyll supplies the energy required for the reaction of photosynthesis.
   C. Photorespiration lowers the efficiency of photosynthesis by removing water from the Calvin Cycle.
   D. No oxygen is produced during the noncyclic electron flow of light reaction.

4. A biochemistry graduate student isolates all the enzymes of TCA cycle and adds OAA and acetyl CoA, including the appropriate energy precursors, cofactors, and water. Which of the following will not be a direct product of his experiment?
   A. ATP
   B. GTP
   C. NADH
   D. CO_2

5. A 58-year-old man develops progressive lower extremity weakness, slurring of his words, and weakness of his hands. A neurologist performs a thorough workup, confirming the diagnosis of ALS (amyotrophic lateral sclerosis). The patient recalls that his father had similar symptoms and eventually died of respiratory failure. Some patients with the familial form of ALS have a defect in the enzyme that normally catalyzes which of the following reactions?
   A. The conversion of peroxide to water and oxygen.
   B. The conversion of superoxide to hydrogen peroxide and water.
   C. The conversion of carbon tetrachloride to the CCL3 radical.
   D. The regeneration of oxidized hemoglobin (methemoglobin).

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6. What is the source of carbons for the Calvin cycle?
   A. glucose
   B. carbon dioxide
   C. glycogen
   D. glyoxylate

7. The key enzyme in the regulation of fatty acid synthesis is _____.
   A. Acetyl CoA carboxylase
   B. AMP activated protein kinase
   C. Protein phosphatase
   D. Acyl – CoA synthetase

8. Before a fatty acid can enter the fatty acid spiral, it must be activated and then shuttled across the inner mitochondrial membrane. The activating agent and shuttle molecule are _____ and _____, respectively.
   A. CoA and carnitine.
   B. CoA and citrate.
   C. acetyl CoA and carnitine.
   D. acetyl CoA and citrate.

9. Which of the following statements about the urea cycle is **TRUE**?
   A. Argininosuccinate is lysed to urea and ornithine in the urea cycle.
   B. Carbamoyl phosphate supplies both of the nitrogen atoms of urea in the urea cycle.
   C. The formation of urea from the urea cycle yields energy.
   D. Arginine is hydrolyzed to urea and ornithine in the urea cycle.

10. Which of the following diseases **IS NOT** caused by a defect in purine metabolism?
    A. Lesch-Nyhan syndrome
    B. Beriberi
    C. Gout
    D. Severe Combined Immunodeficiency Disease

11. A secondary metabolite that is used in combination with diet, weight-loss, and exercise for lowering cholesterol to reduce risk of cardiovascular disease is called _____.
    A. penicillin
    B. nicotine
    C. artemisinin
    D. lovastatin

Continued...

12. An alkaloid used as an analgesic and cough suppressant is_____.
    A. caffeine
    B. nicotine
    C. morphine
    D. resveratrol

13. What is the primary source of energy used by the liver?
    A. glucose
    B. lactate
    C. α keto-acids
    D. ketone bodies

14. Which of the following statement about the carbon skeletons of amino acids is **FALSE**?
    A. Ketogenic amino acids can give rise to acetyl-CoA.
    B. Glucogenic amino acids can give rise to glucose in starvation.
    C. Ketogenic amino acids give rise to glucose.
    D. Some amino acids are both glucogenic and ketogenic.

15. A 19-year-old, African American male military recruit is about to be sent to Iraq on his assignment. In preparation for his tour of duty, he is given a prophylactic dose of primaquine to prevent malaria. Several days after he begins taking the drug, he develops fatigue and hemolytic anemia. Which of the following proteins is likely deficient?
    A. Fructokinase
    B. Aldolase
    C. Glucose 6-phosphate dehydrogenase
    D. Galactokinase

16. Which of the following statements about metabolic fates of pyruvate after glycolysis are **TRUE**?
    i. In the presence of oxygen, pyruvate can be oxidized to acetyl-CoA, which enters the citric acid cycle for further oxidation
    ii. Pyruvate can be converted to oxaloacetate, which can be a precursor in gluconeogenesis.
    iii. In the absence of oxygen, pyruvate can be converted to ethanol by microorganism.
    iv. In the absence of oxygen, pyruvate can be converted to lactate in the exercising muscles and red blood cells.
    A. i and ii
    B. ii, iii, iv
    C. i, ii and iii
    D. i, ii, iii and iv

Continued...

17. Acetyl-CoA can be derived from _____.
    i. glucose 6-phosphate
    ii. alanine
    iii. pyruvate
    iv. acetoacetate
    A. i and iii
    B. ii, iii and iv
    C. iii and iv
    D. i, ii, iii and iv

18. In *de novo* synthesis, the pyrimidine ring is assembled using_____.
    i. bicarbonate
    ii. aspartate
    iii. glutamate
    iv. glycine
    A. i and ii
    B. ii and iii
    C. i and iii
    D. i, ii, and iii

19. Which of the following statements about the citric acid cycle are **TRUE**?
    i. It generates two CO_2, three NADH, one $FADH_2$ and one GTP for each acetyl-CoA.
    ii. It is the only metabolic process in aerobic organisms that produces ATP.
    iii. Its intermediates may be removed to make the amino acids glutamate and aspartate.
    iv. It is linked to the electron transport chain through pyruvate dehydrogenase complex.
    A. i and ii
    B. iii and iv
    C. i and iii
    D. iii and iv

20. The synthesis of CTP from UTP requires UTP and _____.
    i. glutamine
    ii. ATP
    iii. glycine
    iv. NADH
    A. i only
    B. i and ii
    C. i, ii, and iii
    D. ii, iii and iv

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MULTIPLE CHOICE QUESTION ANSWER SHEET

TABLE NO: _____ STUDENT ID: _____

SUBJECT: _____ SUBJECT CODE: _____

1. (A)(B)(C)(D)	2. (A)(B)(C)(D)	3. (A)(B)(C)(D)	4. (A)(B)(C)(D)
5. (A)(B)(C)(D)	6. (A)(B)(C)(D)	7. (A)(B)(C)(D)	8. (A)(B)(C)(D)
9. (A)(B)(C)(D)	10. (A)(B)(C)(D)	11. (A)(B)(C)(D)	12. (A)(B)(C)(D)
13. (A)(B)(C)(D)	14. (A)(B)(C)(D)	15. (A)(B)(C)(D)	16. (A)(B)(C)(D)
17. (A)(B)(C)(D)	18. (A)(B)(C)(D)	19. (A)(B)(C)(D)	20. (A)(B)(C)(D)

SECTION B: SHORT ANSWER TYPE QUESTIONS [SAT – 40 marks]

Question 1

A. Briefly describe the role of uncouplers in oxidative phosphorylation. [1 mark]

B. Many soft drinks contain citric acid as a significant part of their flavor. Is this a good nutrient? Briefly explain your answer. [1 mark]

C. What is the difference between substrate-level phosphorylation and oxidative phosphorylation in the formation of ATP? [2 marks]

D. Would you expect the citric acid cycle to be more or less active when a cell has a high ATP/ADP ratio and a high $NADH/NAD^+$ ratio? Give the reason for your answer. [2 marks]

E. Why does ATP production require an intact mitochondrial membrane? [2 marks]

F. What are the two phases of glycolysis? Describe the energy input and output of these two phases. [2 marks]

Continued...

Question 2

A. What is the effect of photorespiration on photosynthesis? [2 marks]

B. Explain why Calvin cycle is dependent on the light reaction. [2 marks]

C. Would you expect the production of sugars by plants in photosynthesis to be an exergonic or endergonic process? Explain your answer. [1 mark]

D. What are the two major roles of Cori cycle in muscle? [1 mark]

E. What is the difference between anabolic and catabolic reactions? [2 marks]

F. NADPH is an inhibitor of the pentose phosphate pathway. What is the metabolic logic behind this regulatory process? [1 mark]

G. List two types of metabolic reactions. [1 mark]

Question 3

A. What are the three sources used as the carbon skeletons for amino acids? [1.5 marks]

B. Given the function of nucleotides, would you expect their synthesis to be simple or complex and diverse? [1.5 marks]

C. What is the advantage of channeling intermediates by carbamoyl phosphate synthetase? [2 marks]

D. Describe a clinical treatment for phenylketonuria. [1 mark]

E. What biomolecules are synthesized from cholesterol? Give two examples. [1 mark]

F. Distinguish three differences between fatty acid synthesis and degradation. [3 marks]

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Question 4

A. What is metabolic engineering? Give two advantages of metabolic engineering. List two strategies used for metabolic engineering. [3 marks]

B. Give two sources of glucose 6-phosphate in liver cells. [1 mark]

C. Diabetes is a common metabolic disease often resulting from obesity. Define the Type 1 and Type 2 diabetes. [2 marks]

D. Why is it misleading for researchers to study biochemical pathways separately? [1 mark]

E. What are the alternatives measurement other than body mass index (BMI)? Name two examples. [1 mark]

F. You are planning to go on a strenuous hike and are advised to eat plenty of high-carbohydrate foods, such as bread and pasta, for several days beforehand. Suggest a reason for the advice. [2 marks]

End of paper